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Notes on the Habits of Some Solitary Wasps that Occur in Kansas,

With the Description of a New Species.

BY F. X. WILLIAMS.

Plate XXXIII.

Family NYSSONIDÆ.

Harpactus gyponæ n. sp.

Pl. XXXIII, fig. 4, adult ♀; fig. 5, *Gypona cinerea* (its prey.)

♀. Form moderately stout. Anterior margin of clypeus broadly subtruncate, the sides rounded (when the clypeus is viewed a little from below it is broadly and shallowly emarginate), rim narrow; labrum a little bilobed mesad; inner eye margins parallel; frons (up to the anterior ocellus) a little longer than broad, and with a faint indication of an impressed median line; ocelli forming a low triangle; antennæ rather slender, somewhat thickened apically, joint 3 one-fourth longer than 4; head shining, with large scattered punctures and very fine close ones. Scutum and scutellum punctate about as in head, the suture between the two sclerites foveolate; pleuræ with fine close punctures and large scattered ones; mesopleuræ and metapleuræ with a distinct suture between them; mesopleuræ separated from the mesosternum by a carina extending from the middle coxæ to the prothoracic tubercles. Wings not extending to tip of abdomen; primaries with a rather weak stigma; the marginal cell pointed apically, the second submarginal cell receiving both recurrent nervures, the third submarginal extending a little beyond the marginal, and the submedian cell longer than the median along the externo-medial nervure; secondaries with the cubitus originating well beyond the submedian cell. Legs moderately stout and spinose, the fossorial comb (on fore legs) well developed. Disc of propodeum with the enclosed triangle bearing about fourteen carinæ, all basad except the two forming the median furrow; these two extend rather irregularly

beyond the apex of the triangle to anastomose and form the median carina in the longitudinal depression of the posterior face; along the outer sides of the triangle are a number of short carinæ; the rest of the propodeum is finely punctate and has large sparse punctures in addition. Abdomen polished, evenly rounded, strongly punctate except the first two dorsal segments, which have fine close punctures and large sparse ones; segment 2 has large coarse punctures laterally and ventrally; first ventral segment strongly carinate mesad at base and at sides; ventral segments 1 and 2 have their opposing margins somewhat raised and separate mesad; viewed laterally, ventral segment 2 is transversely excavate behind its thickened anterior margin (see cut); pygidium bare, rather

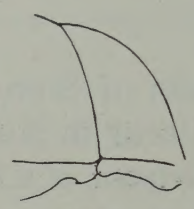

FIG. 1.

slender and narrowly rounded apically, with large coarse punctures and a distinct lateral carina for more than its apical half, the sides nearly straight. *Light rufous*, except the dark ocelli, the black tip of mandibles, sometimes the venter of the abdomen in part (which is dusky in the paratype), and a large creamy yellow lateral spot along the posterior margin of the second abdominal tergite and a weaker spot mesad on the basal half of the fifth tergite. Wings clear (with a faint infuscation in marginal and submarginal cells), yellowish in age; stigma creamy yellow, venation dark brown. Face almost bare, some silvery pile on clypeus, and plenty of it on pleuræ of thorax and propodeum and on the abdominal spots, especially the two lateral ones; elsewhere the pile is sparse. Length of type, 7.5 mm.

Two ♀ ♀, Grant county, Kansas; 2800 feet; July 25, 1911; F. X. Williams. Type in University of Kansas.

In Fox's key to the North American species of *Gorytes*, which genus is to some extent synonymous with *Harpactus* (Proc. Acad. Nat. Sci. Phil., 517; 1895), this insect runs either to *G. pictifrons* Fox, or *nigrifrons* Sm., depending on whether the wings are entirely clear or subapically infuscate. I do not believe it to be closely related to either of the above species, however.

Two specimens of this short-winged and rather terrestial species were observed on the flood plain of the north fork of the Cimarron river, Grant county, Kansas, at the end of July, 1911.

The soil here was sandy and interspersed with small weeds and buffalo grass; in the latter *Gypona cinerea* Uhl. (fig. 5),[1] the prey of *Harpactus* occurred. This bug, which belongs to the homopterous family Jassidæ, is an insect of stout form, and pale grayish brown color. It appeared to be partial to buffalo grass.

Harpactus does not wander far from her burrow in search of her prey. She proceeds at a rather slow and deliberate gait, inspecting the clumps of grass in a thorough manner. She very seldom ventures up a stem, and when a bug is found it is easily captured and subdued. In some cases the bugs, as if unsuitable, are not transported to the wasp's burrow, but left afield.

The first wasp of this species seen, after stinging (?) and malaxating a bug, selected a nesting site, where she dug for one hour and twenty-five minutes. After all this time and labor, however, she failed to make use of the burrow.

The second wasp was first noted at 8:54 A. M., when she was carrying a bug, holding it venter up beneath her, using her middle pair of legs for this purpose.[2] Thus burdened she disappeared into a rather large and sloping tunnel.

At 9:02 she carried in another *Gypona*, this time venter down. In this case she experienced considerable difficulty in locating her burrow, although she had found it immediately on her former trip. *Harpactus* remained within her nest for half an hour. Some of this time must have been employed in making another cell, for she finally backed out, throwing out the soil with her well-fringed fore feet, but carrying out the larger pieces of dirt in her jaws. She ran in and backed out several times, and finally came out head first (an almost invariable sign, in a number of Sphecoidea observed, that work

1. Identified by Prof. E. D. Ball.

2. It is interesting as well as instructive to note the several methods of carrying their prey employed by the solitary wasps. The Pompilidæ, or spider wasps, most frequently seize the spider by one of its legs and proceed backward with it; a smaller number of species bite off one or more of the victim's legs. The Larridæ, which store their nests with saltatorial Orthoptera, seize their victim's antennæ with their mandibles and hold the body with one or more pairs of legs; some, as certain *Tachysphex*, employ the first and second pairs of legs in dragging their prey over the ground—here the smoothest, and therefore the surface of least resistance, viz., the dorsum of the orthopteron, is next the ground. The Sphecidæ, as shall be seen, have much the same habits as the above. A species of *Diodontus* (Pemphredonidæ) seizes its small, weak victim (a plant louse) with her jaws by the ventral part of its prothorax. *Miscophus* (Larridæ), as has been observed by C. Hartman, grasps "the paralyzed spider with her mandibles by two or more of its legs, slings it on her back and marches off with it, walking forward, the spider hanging rather to one side in an uncomfortable and rather awkward looking manner." In the Nyssonidæ, *Harpactus gyponæ* carries the bug beneath her, holding it with the middle pair of legs, but she does not seize it in addition with her mandibles by its antennæ, which are very small and slender. It appears that this diversity in habit is in each case the best method of carrying the prey, which for various species of wasps often differ considerably in size and structure.

within is completed), made a short locality study, and sallied forth. Within half an hour she captured another bug at a distance of fourteen feet from her burrow. She had hardly gone one-third the distance to the latter when a roving tiger beetle (*Cic. punctulata*) spied her, and, giving chase, drove her off.

On digging out the tunnel, it was found to slope steeply for a short distance below the surface; the wasp within was about three inches down, seemingly employed in excavating a cell. Still further down were two neat and well-separated subspherical cells, each containing four bugs. From the ventral side of the abdomen of what I believe was the only immature homopteron of the lot, protruded what appeared to be one of the Stylopidæ; on another bug, below its lateral line and secured just outside of one of the hind coxæ, its free end pointing cephalad, was the wasp's egg.

Being unable to rear an imago from this egg, my observations on the species were here ended.

Family MIMESIDÆ.

Mimesa argentifrons Cress.

Pl. XXXIII, fig. 1, ♀; fig. 3, *Athysanus exitiosa.*

This is a slender red and black wasp about 10 mm. long, not uncommon in Kansas. One of these insects, located in Ness county early in July, had excavated her tunnel in sandy soil at the very base of a large cottonwood tree. Over the nest rose a cone formed of agglutinized grains of sand, quite frail and crude when compared with the tubes of certain *Odyneri.* The base of the cone was surrounded by loose ejected sand; the height of the whole affair above the ground was one and three-eighths inches; the width at base, two and one-fourth inches. *Argentifrons* stores her cells with *Athysanus exitiosa* Uhl,[3] a small species of Jassidæ, which she holds in the same manner as does *Harpactus gyponæ,* but the prey of the mimesid, being small in comparison with the wasp, is always borne on the wing. When obstacles were placed over the entrance to the nest, the wasp would pry them off or scratch under them, never releasing her hold on the bug, however.

The tunnel was nearly vertical, and at least eight inches deep; I was able to locate but one cell, and this contained a number of bugs.

3. Identified by Prof. E. D. Ball.

Family SPHECIDÆ.

Palmodes rufiventris Cress. and *læviventris* Cress.

These are both active wasps about 20 mm. long. Both have dark, smoky wings; *rufiventris* has the abdomen reddish, while *læviventris* is all shining black. Both of these wasps were noted in western Kansas, where they preyed upon *Stipator*, probably *stevensonii*, one of the Orthoptera of the subfamily Decticinæ, or shield-back grasshoppers.

Prionony x thomæ Fab.

This is a quite common and rather slender wasp with subhyaline wings, red abdomen, head and thorax more or less ornamented with silvery pile, and with a length of about 15 mm. The insect has much the same habits as *P. atrata*, a larger and entirely black species. Like the latter, *thomæ* has the habit of depositing her prey in a place of safety while she excavates her one-celled tunnel. Of the two specimens observed nesting, both secured a tryxaline locust for their burrow, one belonging to the genus *Amphitornus*, the other to *Aulocara*.

These wasps, at least in the male sex, in common with many other Specidæ, congregate in some numbers on weeds, where they pass the night or remain during unfavorable weather. Such "clumps" of wasps are a common sight on Russian thistle in western Kansas.

Prionony x atrata St. Farg.

Pl. XXXIII, fig. 2, vertical section of burrow containing an *Aulocara* locust; fig. 6, dorsal view of *Melanoplus lakinus*, showing wasp egg (*E*) *in situ*; fig. 7, ♀.

A number of these very interesting shining black wasps were studied afield. Their highly specialized habits are scarcely if at all inferior to those of the well-known *Ammophilas*.

P. atrata occurs plentifully throughout western Kansas, but it was in the southwestern portion of the state that this species was best observed.

It preys upon several species of the short-horned grasshoppers or locusts (Acridiidæ), insects always far weightier than the wasp in question. Only one locust is stored in the short, steep burrow. But the prey is captured before the nest is begun (the contrary is true in all the Larridæ I have observed), and usually placed on some slight elevation,[4] as a tuft of grass, while *atrata* excavates her burrow.

4. The Peckams have noted a similar habit in some of the Pompilidæ.

The nesting activities were in a few cases watched from beginning to end, and the following field notes will serve to illustrate in a degree the habits of the female wasp:

Grant county, July 21, 1911. While walking in the sandy valley of the north fork of the Cimarron river, I came across a *Prionony x atrata,* at 2:35 P. M., astride a locust (*Aulocara elliotti*), which lay venter down on the ground. The wasp held the base of the locust's antennæ in her jaws and was dragging it to a tuft of grass near by. She placed it on this slight elevation, and after a short search selected a hoof print hard by in the sand as her nesting site. Bracing herself well with her second and third pair of legs, she dug very rapidly under the broken crust of sand with her jaws and fore legs. At intervals she ceased from her labors to examine the locust on the tuft of grass, two feet away. This being a region infested with ants, the precaution was well taken. She was apparently worried at being able to locate her prey only after quite a search, and so when she finally found the same she seized it, and, bringing it much nearer her incomplete burrow, again placed it free from the ground, on a bent grass stem. In a short time the burrow was finished and the locust stored within, but not before a tachinid fly had viviposited upon the latter.

Prionony x filled up the tunnel by backing in, throwing in the soil at the same time, subsequently using her head, more specifically, her clypeus and jaws as a packer or ram. While thus engaged she sometimes assumed an almost vertical position. She dug a little in the opposite side of the hoof print in order to supply more soil to fill in with; when this was accomplished she did considerable leveling, smoothing over the tunnel site with brisk strokes or her feet. This done to her satisfaction, she sought to further disguise the place by depositing thereon pieces of soil (often several times her own weight), twigs, etc. She did this last work very carefully. At about 4:10 P. M. the task was complete. After taking a short rest she sallied forth afoot in search of her prey. Her right of way was unquestioned; indeed, the various locusts in her path leaped away at her approach, and on two occasions an affrighted *Hadrotettix* (a large œdipode locust) spread out its wings in a startling fashion, while still other acridians raised their hind legs in a defensive attitude. Finally, at 4:20 P. M., she found her prey—a mature *Aulocara.* Pouncing upon it,

she clasped the under side of its thorax, her head toward the caudal end of her leaping prey, her jaws applied to the latter's body. She clung on tenaciously and soon quieted it with a sting, administered somewhere on the locust's neck. After this brief but strenuous period she took a short rest; then pulling her prey up a Russian thistle plant until the former was about one and one-half inches above the ground, she set to work locating a nesting site. This she soon found, only six inches away. She commenced to dig at 4:26 P. M. She visited her prey on the Russian thistle three times before the hole was excavated, which was at 5 P. M. Finally grabbing the *Aulocara* by the antennæ, she dragged it to just before her burrow, into which she backed. A little *Tachina* fly which had been carefully watching the wasp while digging her tunnel, and even following her on her occasional tours of inspection to the weed where the *Aulocara* lay, now availed herself of the opportunity presented her by the wasp's disappearance in the tunnel to viviposit at the base of the locust's elytron. Hardly was the parasite's work accomplished when *Prionopyx*, emerging, seized her victim by the antennæ and dragged it within. She remained inside long enough to lay her egg on the locust. She filled her burrow as in the first instance, and completed her work at 5:25 P. M., or one hour and fifteen minutes after she had filled up her first nest. Like the first tunnel, this one was in a depression where the soil crust had been broken. The wasp was caught and her nest dug up. This sloped quite steeply up to the subhorizontal cell; here, on its venter, lay the locust, the rather long, curved wasp egg (*E*, fig. 6) secured in the membrane just anterior to one of the hind femora and immediately dorsad the hind coxa. This position is always chosen by this wasp. The hole was of rather large bore and measured two inches deep by two and one-half inches long.

These wasps sometimes occur in small, ill-defined colonies, and while at work at their tunnels could often be located by reason of the squeaky buzz which they emitted from time to time, and which was plainly audible from a distance of a dozen feet. In Morton county, where the soil was rather wet and heavy from recent heavy rains, the wasp used her jaws to a large extent and brought out considerable loads of earth, which she held between her open jaws and her fore legs. She carried out as many as four or five loads per minute. The tunnels are

quite uniform in structure, but may not be more than one and one-half inches deep and less than two inches long.

The orthopterous prey of *Prionopnyx atrata* is rather varied. As far as observed, the victims were always mature and usually of the smaller species of *Melanoplus* (including *lakinus*). A large specimen of *atrata* was observed by one of the members of the Entomological Survey of 1911, with a ♀ *Melanoplus differentialis,* an insect of considerable strength and magnitude. The author took an *atrata* in Seward county which had captured a ♀ *Mermiria neomexicana.*

While the evidence at hand is incomplete, it seems more than probable that the common red-banded bembecid wasp, *Stizus unicinctus* Say, plays the part of a burglar and uses the locust captured by *Prionopnyx atrata* as food for her own young. *Unicinctus* is a rather compact insect, somewhat inferior in size to and less powerful than the sphecid. It occurred plentifully in western Kansas, where it was sometimes seen flying low over the ground, alighting now and then as if inspecting the locality for a nest of some sort. In Stanton county one of these wasps was observed to hover about a freshly made tunnel, apparently that of a *Prionopnyx,* which it entered while the sphecid was away. The latter had brought an *Aulocara* near this burrow, which, being occupied by *Stizus,* was finally deserted by the disgusted *Prionopnyx.*

In Morton county, July 7, 1911, I came upon *Stizus unicinctus* engaged in smoothing over a spot with her feet. I unearthed what proved to be a filled-up burrow, which in form and dimensions resembled that of a *Prionopnyx.* In the single cell lay a *Melanoplus.* But where the *Prionopnyx* egg was to be expected on this locust was only a small bit of soft matter, probably the remnant of the specid egg destroyed by the *Stizus,* while cephalad of these remains was a short wasp egg, doubtless that of *Stizus.*

Certainly the short-legged *Stizus unicinctus* does not appear to be a sufficiently powerful insect to capture and subdue locusts of the size and vigor as those which serve as the prey of *Prionopnyx.*

Further observation upon the interrelation of these two insects is needed, so that their complete life history may be brought to light. Although much has been written on the solitary bees and wasps, the data on their postembryonic development is exceedingly meager, and no doubt offers a wide and interesting field for the investigator.

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